GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Heat recovery in energy sector and industry, PG_00057264		
Field of study	Power Engineering, Power Engineering, Power Engineering		
Date of commencement of studies	February 2022	Academic year of realisation of subject	2022/2023
Education level	second-cycle studies	Subject group	Optional subject group Subject group related to scientific research in the field of study
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	Polish
Semester of study	2	ECTS credits	3.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Zakład Ogrzewnictwa, Wentylacji, Klimatyzacji i Chłodnictwa -> Institute of Energy -> Faculty of Mechanical Engineering and Ship Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Jan Wajs	
	Teachers	dr hab. inż. Jan Wajs	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	0.0	15.0	0.0	0.0	30

E-learning hours included: 0.0

Learning activity and number of study hours

Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM
Number of study hours	30	8.0	37.0	75

Subject objectives

Teaching in the field of the energy technologies and efficient energy utilization

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_W08] as knowledge about development trends in the field of known technologies and non-technical aspects to solve simple engineering tasks in the field of power systems and equipment or transmission networks and internal installations	The student knows a modern technologies of waste energy management, in particular the technologies of heat recovery from a low-temperature media. The student knows methods of heat transfer enhancement and directions of recuperators' development for an effective heat recovery.	[SW1] Assessment of factual knowledge
[K7_U06] is able to apply basic and advanced knowledge of power equipment and transmission network and internal installations to the preliminary design of a modern power plant or part thereof	The student presents a technical problem solution in the form of a conceptual design, with thermodynamic, ecological and economic analyzes.	[SU1] Assessment of task fulfilment [SU4] Assessment of ability to use methods and tools [SU5] Assessment of ability to present the results of task
[K7_W10] knows the basic installations of advanced energy systems, transmission networks and internal installations and their impact on the environment	The student understands the technological /energy processes and is able to indicate ways of reducing their negative impact on the environment.	[SW1] Assessment of factual knowledge
[K7_W06] knows the extended issues of reliability of power equipment and diagnostics of defects in this equipment	Student has knowledge about the operation of energy systems and in the basis of thermal-hydraulic measurements is able to conclude about their technical states.	[SW1] Assessment of factual knowledge

Subject contents

Introduction includes definition of energy, methods of energy transfer, mechanisms of heat transfer and methods of heat transfer enhancement in the recuperators. Waste energy, its types and general classification of its usage. The economic effect of waste energy recovery. Evaluation of waste energy resources. Physical and chemical recuperation. Chemical energy of solid wastes. Thermal energy storage. Fundamentals of heat recovery from ventilation systems, air conditioning systems and compressors cooling systems. Cooling sorption technologies supplied by waste heat. Estimation of environmental benefits from system utilizing waste heat. Examples of installations/facilities utilizing waste heat. Study trip to chosen company that uses heat recovery.

<table>
<tr><td>Prerequisites and co-requisites</td><td colspan="3">Knowledge from courses: Thermodynamics, Heat transfer and Polygeneration systems</td></tr>
<tr><td>Assessment methods and criteria</td><td colspan="3"><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Laboratory report</td><td>100.0%</td><td>30.0%</td></tr>
<tr><td>written assessment of the lecture</td><td>56.0%</td><td>70.0%</td></tr>
</table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td colspan="2">U.S. Department of Energy, "Waste Heat Recovery - Technology and Opportunities in U.S. Industry". BCS, Incorporated, 2008. https://www1.eere.energy.gov/manufacturing/intensiveprocesses/pdfs/waste_heat_recovery.pdf</td></tr>
<tr><td>Supplementary literature</td><td colspan="2">No requirements</td></tr>
<tr><td>eResources addresses</td><td colspan="2"></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="3">Types of waste energy and their examples.
Method of calculation of heat exchanger effectiveness.
Technologies of heat utilization from high temperature processes.
Technologies of heat recovery from low temperature processes.</td></tr>
<tr><td>Work placement</td><td colspan="3">Not applicable</td></tr>
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